body and having a central passage rotatable in the valve body between open and closed positions, and at least one seat disposed between the ball and the valve body. The ball and seat each comprise a titanium substrate and an ultrafine, preferably nanostructured titania coating. The coating can have a titania phase and a phase immiscible with the titania phase in a proportion effective to inhibit grain growth. The immiscible phase preferably comprises from 5 to 45 percent by volume of the coating. The immiscible phase can be selected from zirconia, tantalum oxide, boron carbide, silicon carbide, titanium carbide, diamond and combinations thereof. The coating can have a ground and polished surface. The coating can have a thickness from 100 to 500 microns, or preferably when it has a ground and polished surface, a thickness of from 100 to 200 microns. The titania coating preferably has a grain size less than 500 nm. The coating is preferably deposited by thermal spray application of a powder comprising spherical agglomerates in a size range of from 10 to 45 microns comprising a mixture of ultrafine particles of less than 0.3 microns.

[0028] In a preferred embodiment, the thermal spray process comprises the atmospheric plasma spray (APS) process. In the APS process, a jet of gas is heated by an electric arc to form a plasma jet. Powder feedstock is injected into the plasma jet to heat the particles and to accelerate them towards a substrate to form a coating. The spray parameters preferably include a gun current of 400 to 500 amps, a primary gas (argon or nitrogen) flow rate of 36 to 48 SLPM, a secondary (hydrogen) gas flow rate of 7 to 12 SLPM, a spray distance of 50 to 80 mm, a powder feed rate of 36 to 60 g/min, a maximum substrate surface temperature of 200°C, and a spray thickness of 125 to 500 microns. The coated substrate is then allowed to cool to ambient temperature.

[0034] **Example 1** A nanostructured titania on titanium ball valve was made by coating the Grade 5 titanium seats **112, 114** and ball **108** of the valve shown in Figs. 2-5. An atmospheric plasma spray (APS) gun was used, manufactured by Sulzer Metco, model number 7M with a Sulzer Metco feeder, model number 9MP. Prior to applying the coating, the component surface was grit blasted using alumina (20 to 36 microns) to 2-3 mils and heated to above 100 °C. The powder used was ultrafine titania agglomerates that had been prepared according to specifications (agglomerates

approximately 5 to 45 microns, ultrafine particles approximately 300 nm) by material suppliers. The powder was applied by repeatedly passing the flame over the parts, allowing the parts to cool slightly between passes. The gun current was 400 to 500 A, the primary gas (argon or nitrogen) flow rate was 36 to 48 SLPM, and the secondary gas (hydrogen) flow rate was 7 to 12 SLPM. The powder injection feed rate was 36 to 60 g/min, and the spraying distance was 50 to 80 mm. The part surface temperature was maintained below 200 °C throughout the spray process. The coated ball valve parts were ground and polished to 8 RMS.

[0037] **Example 4** An agglomerated ultrafine composite powder for thermal spray application was produced by: 1) milling mixtures of commercial (micron size range) TiO_2 and 20 volume percent Ta_2O_5 powders down to below 300 nm particle size range; and 2) spray drying with appropriate (1 to 6 weight percent of total solution) organic binders to form spherical agglomerate powder. The milling was carried out in an aqueous-based liquid medium with 30 to 35 weight percent solids. Organic binders used in spray drying included polyvinyl alcohol (PVA) or carboxymethyl cellulose (CMC). The spray-dried powder consisted essentially of spherical agglomerates, in the size range of 10 to 30 μm.

[0038] **Example 5** An agglomerated ultrafine composite powder for thermal spray application was produced by milling mixtures of commercial (micron size range) TiO_2 and 45 volume percent ZrO_2 powders down to below 300 nm particle size range and spray drying with appropriate (1 to 6 weight percent of total solution) organic binders to form spherical agglomerate powder. The milling was carried out in an aqueous-based liquid medium with 30 to 35 wt% solids. Organic binders used in spray drying included polyvinyl alcohol (PVA) or carboxymethyl cellulose (CMC). The spray dried powder consisted essentially of spherical agglomerates, in the size range of 5 to 45 μm.

In the Claims:

Cancel claims 1-11, 21-24, and 27. Please amend claims 12 and 20 with the following. A marked-up version of the amended claim(s), showing the changes made by underlining of the added text and bracketing of the deleted text, is appended hereto.